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LLNL Beryllium-Affected Worker Case Review

Descriptive Analysis 1998–2010

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1.0 Executive Summary

This report documents the cumulative review of the 74 beryllium (Be)-affected[1] workers identified through Lawrence Livermore National Laboratory's (LLNL's) Health Services Department's (HSD's) beryllium lymphocyte proliferation (BeLPT) testing, beginning in 1998 through December 2010. This analysis was conducted to identify individuals or groups of individuals potentially at risk for chronic beryllium disease (CBD) as well as to identify additional working conditions that may contribute to the development of beryllium sensitization and elevated risk of CBD. This review updates previous analyses[A,B] and provides an analysis of 28 additional Be-affected workers identified between April 2009 and December 2010 (2010 Review). The 74 beryllium-affected workers reviewed in the present report include: 4 workers diagnosed with CBD, 37 beryllium sensitized (BeS) workers, and 33 beryllium "concern" workers. This analysis suggests that Be sensitization or "concern" may occur not only among those who had a presumed higher risk for airborne exposure to beryllium, such as machinists, or waste handlers, but also among low risk workgroups who may have been exposed through incidental activities.

The following observations and conclusions were made as a result of the present analysis:

- LLNL's sensitization rate of 2.72% (37/1359) has remained roughly consistent over the past 2 years and is similar to the overall Department of Energy (DOE) registry rate of 2.0% (355/17,716).

- LLNL's CBD rate of 0.29% (4/1359) is less than half of the CBD rate of the overall DOE registry rate of 0.8%[C]. (134/17,716).

- LLNL's "concern" rate is 2.4% (33/1359). There is no comparable DOE registry rate. Identification of "concern" cases represents a conservative approach to workplace safety and is recommended by the Institute of Medicine.

- A newly developed categorization of beryllium exposure, functional job titles, and job activities reveals that individuals providing facility support activities (including computer network, electrician activities, carpentry services, security, Health and Safety services, facility inspection, and locks and keys support), may be at risk for Be sensitization.

[1] Be-affected workers include Be sensitized (2 abnormal BeLPTs), "concern" (1 abnormal and 1 borderline BeLPT) and those diagnosed with CBD.

- Of the 4 CBD cases, 2 workers were identified in the functional job title category of Crafts, 1 as a machinist and 1 as a waste worker. The 2 craft workers reported working in building (B) 321C. The machinist worked both at Rocky Flats and in B321C. To date, none of the 4 workers with CBD require treatment.

- Almost 90% (25/28) of the Be-affected workers identified in the 2010 Review were identified as abnormal/borderline on initial BeLPT testing.

- Of the 74 Be-affected workers, 23% (17/74) were employed less than 10 years. Of these 17 workers, 12 were identified in the 2010 Review. This observation requires additional study.

- With few exceptions, the 28 Be-affected cases identified in the 2010 Review continue to have work histories that can be linked to the small number of facilities having active beryllium operations, task-based activities involving beryllium, or facilities with historical beryllium activities.

- The work histories of Be-affected workers continue to identify the following buildings and locations as the most frequently reported work locations: B321C, B131 High Bay, Site 300 bunkers (B801A, B850, and B851), B231, B241, and B391.

- Over 50% (38/74) of Be-affected workers reported work histories in the B321C – Special Materials Machining Center.

- Exposure monitoring at LLNL, though limited for the Be-affected workers, focused on presumed higher risk activities and indicates that a majority of the operations sampled are well below current occupational exposure limits set by LLNL, DOE, and the Occupational Safety and Health Administration (OSHA).

In June 2010, the results of a review of 50 current and former LLNL workers were published, by the Department of Medicine at the University of California San Francisco (UCSF) in collaboration with LLNL health and safety professionals (Arjomandi, et al [D]). This review suggests that because of lower average levels of beryllium exposure, a smaller proportion of LLNL sensitized workers may go onto to develop CBD when compared to workers at other sites having higher exposures.

This report suggests that Be sensitization or “concern” may not only occur among workgroups who had a presumed higher risk for airborne exposure to beryllium, such as machinists, or waste handlers but also among presumed lower risk workgroups who may have been exposed through indirect or incidental activities. Such activities include crafts (electricians, carpenters, and inspectors), computer technicians, security, and Health & Safety support personnel. The pattern of low exposure levels and sensitization prompts the hypothesis that very little exposure may be required to sensitize some individuals. If the conclusions of the Arjomandi paper hold true over time, these individuals may be at relatively low risk of CBD.

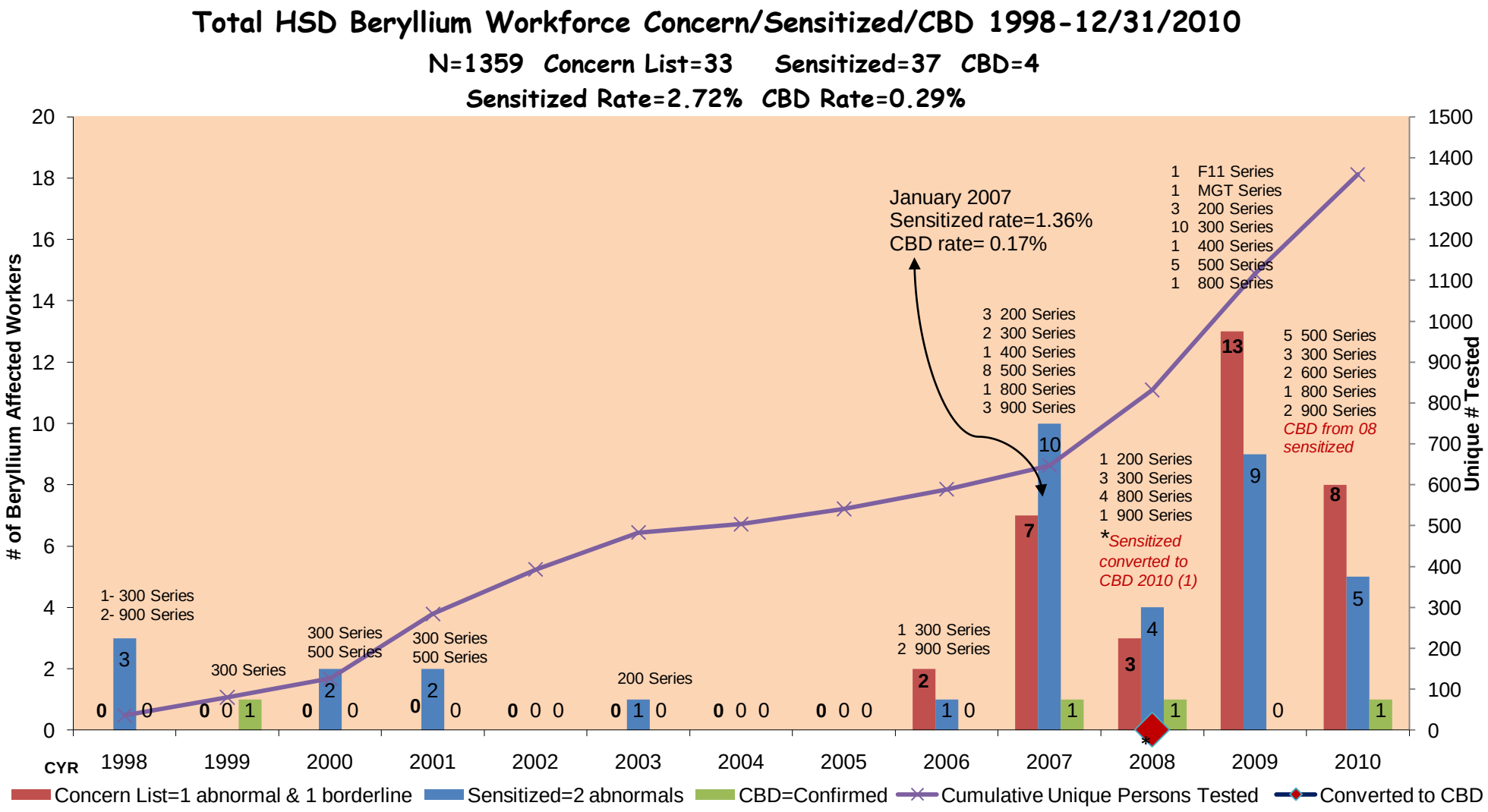
2.0 Background

LLNL has had a Chronic Beryllium Disease Prevention Program (CBDPP) in accordance with Federal Regulation 10 CFR 850 since 1998. The development of LLNL's current CBDPP is based on beryllium health and safety programs that date to the founding of the Laboratory in the early 1950's. An important element of LLNL's CBDPP since 1998 has been an offer of BeLPT testing as part of the voluntary medical surveillance of both current and past Be workers.

Periodically, LLNL analyzes the Be-affected worker population, as well as overall beryllium medical surveillance trends in an effort to identify those job functions, activities, and work locations that may be at an elevated risk of beryllium exposure. LLNL performed such an analysis in March of 2009[B] and in June of 2009[C]. This updates the June 2009 analysis to include workers identified as Be-affected between April 1, 2009 and December 2010 (2010 Review). This report focuses only on workers identified by LLNL HSD's medical surveillance program, and does not include an analysis of former workers who are Be-affected and had been identified by other DOE medical surveillance contractors.

This report documents a continuous evolution of LLNL's beryllium medical surveillance program and identification of exposed workers. When the CBDPP was implemented in 1998, the LLNL beryllium medical surveillance program targeted a limited pool of beryllium workers including beryllium machinists or those workers having the potential for airborne exposure. Beginning in 2006, additional worker groups began participating in BeLPT testing. In addition to the identification of current active beryllium workers through formal work control processes, beginning in January 2009 the offer of BeLPT testing and beryllium medical surveillance was provided via a web questionnaire to any LLNL worker choosing to participate. Communications efforts, identification of additional work groups (e.g., security workforce) with potential for exposure and streamlining the self-identification website process has resulted in a 257% increase (700 to 1800) from January 2009 to December 2010 in worker enrollment in Be medical surveillance. The vast majority of these new enrollees had not previously participated in medical surveillance or BeLPT testing. Monthly beryllium statistics are posted on the internal LLNL website. See Figure 1.

Figure 1. Monthly Beryllium Statistics



Additionally, in 2006 the HSD adopted the new medical descriptive category "concern" in an attempt to be more protective of workers at LLNL. This new category ensures that workers with one abnormal BeLPT and at least one borderline BeLPT receive appropriate medical follow-up and are protected from further exposure to beryllium while in the workplace. This change is consistent with the approach used by the DOE National Supplemental Screening Program and the recommendations of the National Academy of Science Committee on Beryllium Alloy Exposures. The "concern" classification and subsequent work restrictions continue to be an important administrative control. One of the four LLNL CBD cases occurred in an individual identified as "concern."

3.0 Methodology

A cumulative review of the 74 Be-affected workers identified by LLNL HSD from January 1, 1998 through December 31, 2010 was conducted to identify associated occupational factors. Factors that were investigated include job function/title, specific job activities, work locations, duration of potential exposure, potential for exposure prior to beginning employment at LLNL, and participation in medical surveillance. Categorization of cases was similar to the strategy utilized in the independent epidemiological descriptive analysis[B] to include the stratification of possible beryllium exposure of three categories; Direct, Indirect, or Incidental (Table 1). Two new categories were developed to provide additional insight into possible job factors resulting in sensitization: functional job titles and job activities (Tables 2 and 3). Each worker, within the present analysis, was characterized by the authors after review of work area evaluations, exposure monitoring records, and self reported questionnaires for the most likely job functional title and activity at the time of presumed possible exposure.

Table 1. Beryllium Exposure

Direct	Includes workers who had hands-on work with beryllium or beryllium components. Beryllium may be in the form of metal, ceramic, or an alloy. Some representative types of work include: machining, milling, boring, drilling, grinding, polishing, brazing, sputtering, welding, inspecting beryllium components, and handling beryllium contaminated materials in waste streams.
Indirect	Includes individuals working in an area where any type of beryllium work is presently occurring or has occurred, but had no direct contact with beryllium.
Incidental	Includes workers responsible for repairing and/or calibrating machines associated with beryllium. Also included workers who walk through or visit areas where beryllium work was being conducted or had previously been conducted, with no direct beryllium contact.

Table 2. Functional Job Titles

Functional Job Titles	Definition
Administrative	Positions where the primary responsibilities are administrative: paperwork, attending meetings, writing documents, data analysis. Includes both administrative/clerical support and management positions.
Decontamination & Decommission (D&D)	Decontamination, decommissioning and dismantlement activities for laboratories, buildings and facilities. At LLNL, typically these activities are done by the ERD D&D SAT Team.
Technician	Performs technical work, typically in support of experimental programmatic work. Majority of the job is spent in shops, laboratories, or test areas, and is typically hands-on with hazardous materials, or in close proximity to such work.
H&S Support	Provide technical H&S support to programmatic work. Take samples, measure hazardous atmospheres, conditions, and radiation environments. Limited decontamination work. May work hands-on with hazardous materials occasionally, but spends significant time in locations and close proximity to such work.
Laboratory Processing	Majority of the job is spent performing laboratory analysis or chemical/material handling. Includes analytical and synthetic chemistry, metallography, materials science, radiochemistry.
Lasers	Majority of the job is spent preparing for, performing and analyzing data from laser experiments, including constructing and maintaining laser systems, making laser targets, and constructing and fielding diagnostic equipment to gather data from laser experiments.
Waste Processing	Majority of the job is spent in handling, processing, or characterization of hazardous and/or radioactive waste. At LLNL, includes Radioactive Hazardous Waste Management (RHWM) group, specially assigned Decontamination/Crafts & Trades/Laborers that process waste.
Weapons	Majority of the job is spent preparing for, performing and analyzing experiments with weapons components, such as assembling test specimens, performing explosive tests, performing mechanical tests, and performing environmental testing.
S&E	Majority of job is performing professional research involving biology, chemistry, physics, engineering, or mathematics. Frequently works outside of their office in areas such as but not limited to laboratories, testing areas, and construction areas.
H&S Support	Provide skilled H&S discipline (Industrial Hygiene, Health Physics, Industrial Safety Engineer) support to programmatic work. Generally do not work hands-on with hazardous materials, but are in locations and close proximity to such work.
Research	Research involving biology, chemistry, physics, engineering, or mathematics. Frequently works outside of their office in areas such as but not limited to laboratories, testing areas, and construction areas.
Waste Processing	Majority of job is performing professional support of waste management or processing, including chemistry and chemical processing engineering support. Generally do not work hands-on with waste, but are in locations and close proximity to such work.
Crafts & Trades	Building trades including electricians, carpenters, plumbers, pipefitters, and heating/ventilation/air-conditioning workers. Typically not conducted in a fixed location, but in multiple facilities across LLNL.
Carpentry	
Electrician	
HVAC	
Computer Support	Provides hands-on repair of computer equipment in various worksites, including offices, shops, and labs. May have run networking cables and wire, including above ceilings and other normally inaccessible areas.
Facility Support	General services in support of LLNL facility infrastructure. Typically not conducted in a fixed location, but in multiple facilities across LLNL. Includes custodial support, general repairs and maintenance, and upgrades to facility's infrastructure.
Custodian	Trash removal
Inspector	Travels from facility to facility to inspect systems such as alarms, fire extinguishers, utilities, security equipment, etc.
Locksmith	Site wide locks and keys repair and installation.
Warehouse	Travels from facility to facility to pick up and deliver packaged materials.
Machinist	Majority of the job is spent working on metal components to change size and shape, such as machining, milling, grinding, drilling, boring, coating, finishing and polishing.
Security	Duties associated with the administration of security procedures, inspection of buildings and facilities for compliance with security requirements, and the guard force (training, exercises, and guard duty).

Table 3. Functional Job Activities

Administrative
Decontamination & Decommission
Facility Support – H&S Facility Support – inspection Facility Support – carpentry Facility Support – computer network Facility Support – locks & keys Facility Support – Security
Inspection & Handling Inspection & Handling – weapons
Laboratory work Laboratory work – with known Be Laboratory work –with known Be (laser Target)
Machining – Be Machining – non Be
Maintenance on contaminated systems Maintenance on contaminated systems – carpentry Maintenance on contaminated systems – electrical Maintenance on contaminated systems – HVAC
Trash removal
Warehouse supplies
Waste processing

Each worker was characterized by the authors for the most likely exposure route (direct, indirect, or incidental), job functional title and functional job activity, at the time of presumed exposure. Two limitations are noted of the data used in this analysis. LLNL workers, particularly those of long employment history, tend to have performed multiple job assignments, including possible changes in job activities, in a wide variation of work locations. Additionally, the identified functional job title and activity may not reflect the activity at the time of actual beryllium exposure.

4.0 Results

As of December 31, 2010, 1359 individuals have undergone BeLPT testing through LLNL's HSD. Of those 1359 tested, 74 were identified as Be-affected workers:

- 33 had 1 abnormal + 1 borderline BeLPT ("Concern")
- 37 had 2 abnormal BeLPT (BeS)
- 4 were diagnosed with CBD[2]

The sensitization rate among LLNL workers tested from 1998–2010 is 2.72%, and the CBD rate is 0.29%.

[2] To date none of the 4 cases require treatment.

4.1 Beryllium Exposure Categorization

The 74 Be-affected workers were categorized by the potential route of beryllium exposure into 3 categories: direct (n=23 or 31%), indirect (n=25 or 34%), and incidental (n=26 or 35%) (Figure 2).

Figure 2. Potential Route of Exposure n=74

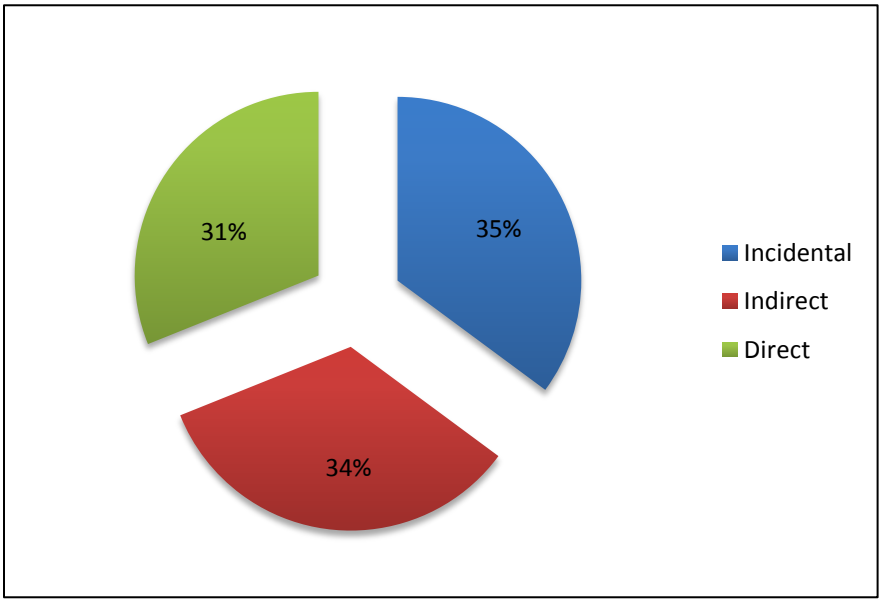
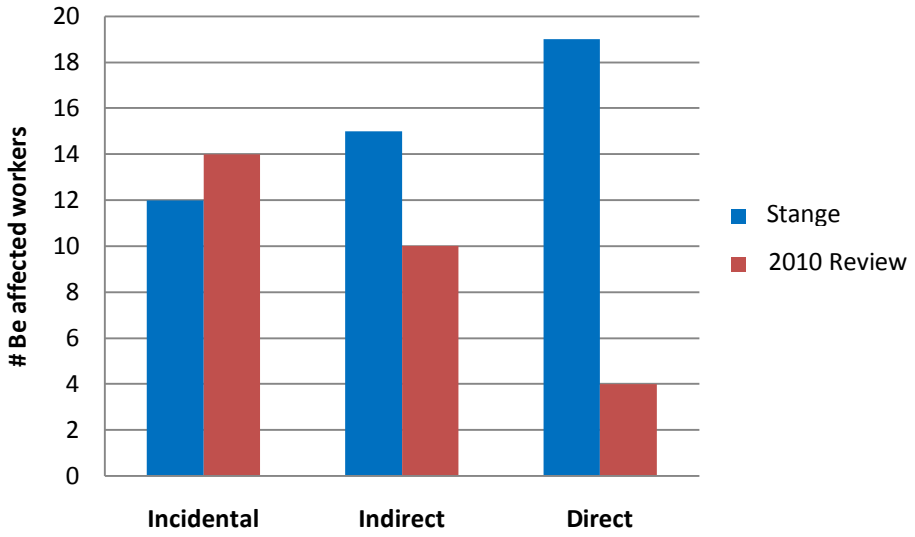


Figure 3 compares and contrasts the 46 Be-affected workers in the Stange[B] review with the most recent 28 Be-affected workers identified in the 2010 Review. The highest proportion of worker exposure was "direct" in the Stange review in contrast to the lowest proportion in the 2010 Review.

Figure 3. Potential Route of Exposure Stange vs. the 2010 Review
Incidental n=26, Indirect n=25, Direct n=23



4.2 Functional Job Title Analysis

The 74 Be-affected workers have been categorized into 9 broad groupings based on functional job titles. The largest groups were among the Technicians (n=29 or 39%) and Machinists (n=16 or 22%) categories. The smallest groups with only one individual (1%) respectively were Administrative and Decontamination and Decommission (D&D) (Figure 4). These 9 groups were further subdivided into a total of 22 subcategories (see Table 3). The largest group, technicians, (n=29) have been further categorized into 5 subgroups. The 29 technicians, were categorized as working in the following functional job titles: weapons components (n=10 or 35%), laboratory processing (n=7 or 24%), waste processing (n=5 or 17%), H&S support (n=4 or 14%), and lasers (n=3 or 10%). See Figure 5.

Figure 4. Functional Job Titles n=74

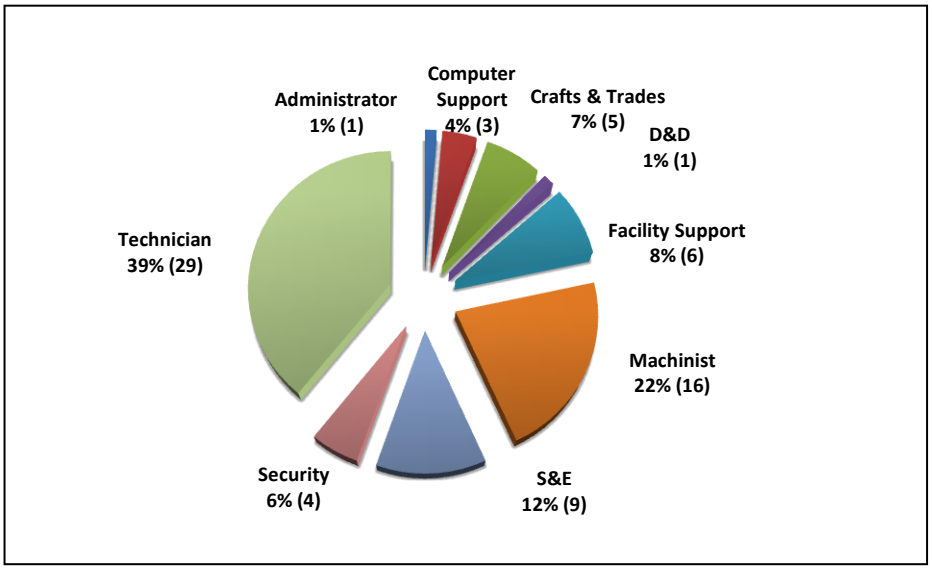
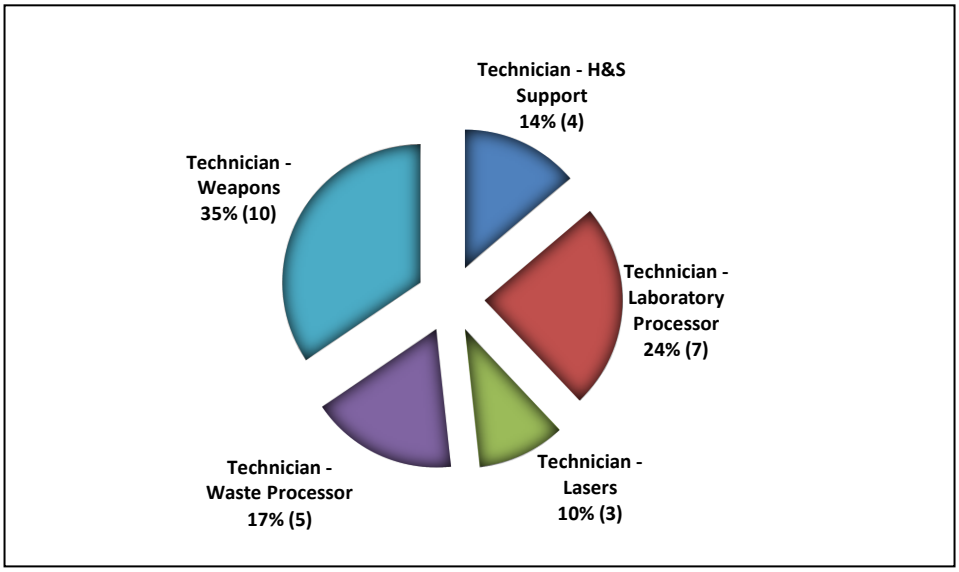


Figure 5. Functional Job Title Technicians n=29



4.3 Functional Job Activities

To provide additional understanding of job factors that may contribute to beryllium sensitization, 10 functional job activities have been developed. Of the 10 categories, Be-affected workers were grouped predominantly in the following 5 functional job activities which were broken down into sub categories. See Table 3. Be-affected workers were categorized into: facility support (n=17 or 23%), machining (n=15 or 20%), laboratory work (n=14 or 19%), inspection and handling (n= 10 or 14%), and maintenance on contaminated systems (n=6 or 10%). The functional job activities least reported in Be-affected workers include warehouse supply (n=1 1%), trash removal (n=1 or 1%) and administrative (n=1 or 1%). Figures 6 and 7 illustrate the distribution of Be-affected workers within the 10 categories.

Figure 6. Functional Job Activities n=74

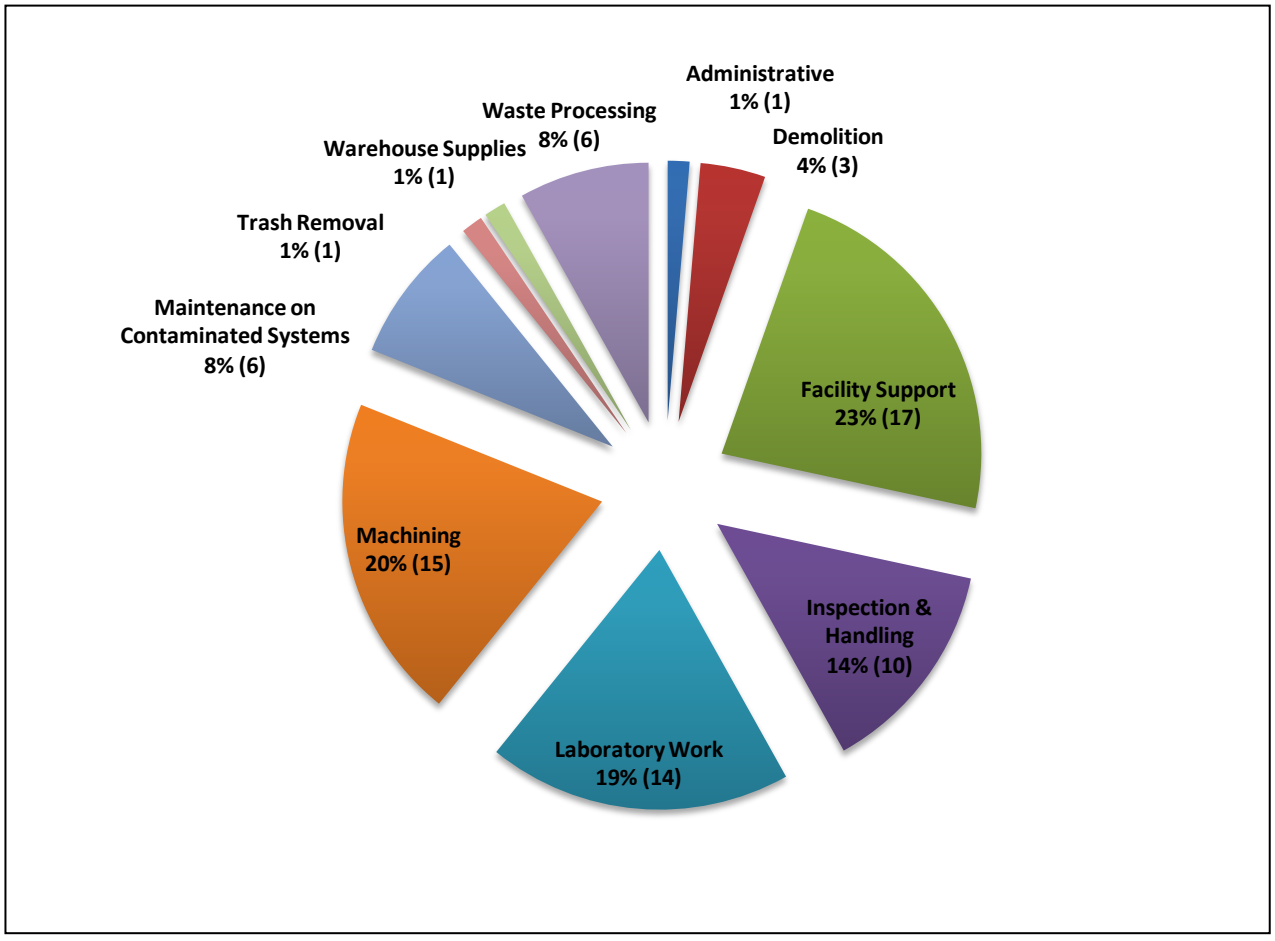


Figure 7. Functional Job Activities

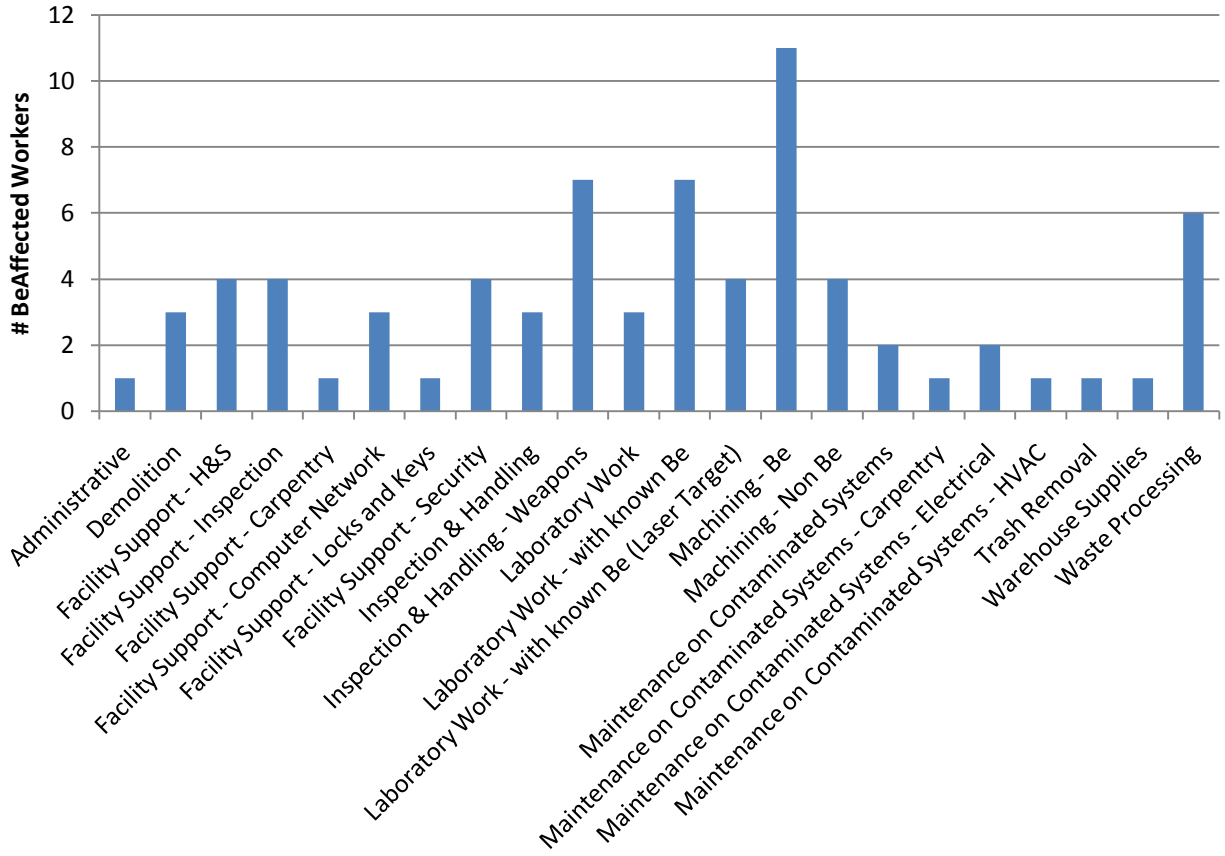
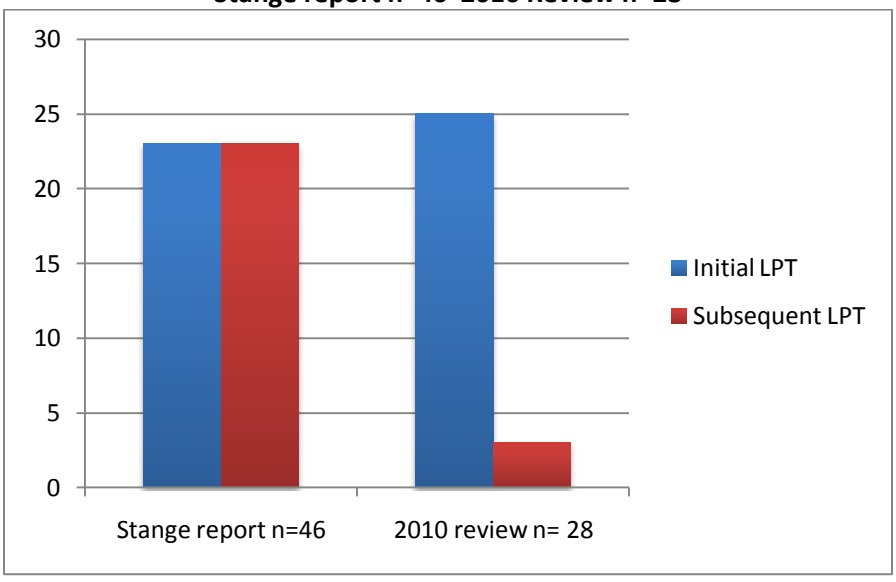


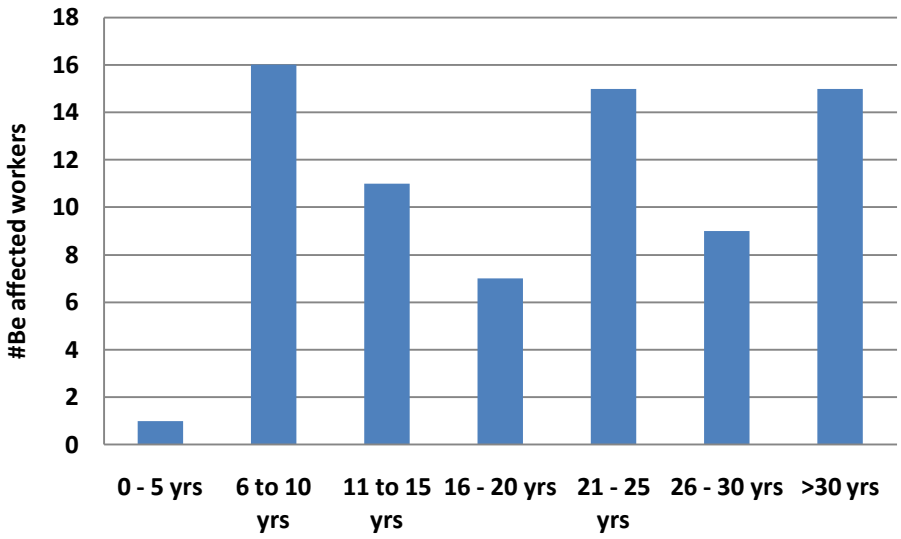
Figure 8. Abnormal/Borderline BeLPT Initial vs. Repeat
Stange report n=46 2010 Review n=28



Since 1998, 46 of the 74 (62%) Be-affected workers have been identified as the result of an initial abnormal/borderline BeLPT, and 26 individuals have been identified as Be-affected as the result of an initial normal BeLPT with a repeat BeLPT in subsequent years resulting in abnormal/borderline. Of the 28 Be-affected workers identified in the 2010 Review, 25 (89%) workers were identified as abnormal/borderline on the initial BeLPT. This may be indicative of the enrollment/increased participation of previously unscreened work groups that may be at risk for Be sensitization. There is currently no way to determine when those workers identified as abnormal/borderline on the initial BeLPT developed beryllium sensitivity (See Figure 8).

The year of first employment at LLNL of the 74 Be-affected workers began as early as 1959 and most recent as 2008. Figure 9 shows that 23% (17/74) of the Be-affected workers identified were employed at LLNL for less than 10 years. Of these 17 workers, 12 were identified in the 2010 Review. This observation requires additional study. Seventy seven percent (57/74) were employed at LLNL for more than 10 years.

Figure 9. Years of LLNL Employment n=74



LLNL's CBD rate of 0.29% (4/1359) is less than half of the CBD rate of the overall DOE registry rate of 0.8%[C]. (134/17,716). Of the 4 CBD cases, 2 workers were identified in the functional job title category of Crafts & Trades, 1 as a Machinist, and 1 as a Waste Processing Technician. While the work activities are consistent with the results of other DOE sites, this observation requires additional follow up. The 2 craft workers reported working in B321C. The machinist worked both at Rocky Flats and in B321C. All 4 workers were hired at LLNL between 1988 and 1994. To date, the 4 workers with CBD do not require treatment.

4.4 Industrial Hygiene Sampling Results

Although the number of beryllium operations and the quantity of beryllium used at LLNL has declined in recent years, the potential for beryllium worker exposures continues to be assessed primarily within the following operations: 1) facility maintenance, renovation, D&D work in buildings where beryllium was historically used; 2) machining operations involving beryllium-containing materials and alloys; 3) materials development and testing facilities; 4) handling and storage facilities; 5) facilities engaged in the laboratory analysis of beryllium samples; and, 6) waste disposition facilities.

Since 1952, the industrial hygiene exposure monitoring program at LLNL has included collection of personal and high-volume area air samples to assess worker exposure to beryllium. In FY2010, LLNL analyzed 2,438 personal and area air samples for various operations covering 21 facilities[3] and found that 92 (3.8%) exceeded the laboratory reporting limit of 0.02 microgram (mcg). Eight-hour time-weighted averages for the samples with detectable beryllium ranged from 0.02 to 0.6 $\mu g/m^3$. Of the 92 samples, 6 (0.2%) exceeded the LLNL airborne action level of 0.2 $\mu g/m^3$.

Prior to 2007, air sampling focused on identifying high-exposure job categories and processes (i.e., machining and explosive testing) to implement controls (i.e., housekeeping, personal protective clothing, and respiratory protection). These personal air sampling results continue to typically indicate low levels of airborne beryllium which are typically below the method detection limit[4]. It should be noted that respiratory protection, when utilized, was primarily focused on high-exposure job categories and may not have been prescribed or utilized by workers with indirect or transient work in facilities with current or historical beryllium operations. Though respiratory protection has been prescriptive for operations that have a potential for airborne beryllium exposure since 2007, a respiratory protection factor has not been applied to the personal air samples collected between FY2007 and FY2010 and may not represent a true representation (i.e., lower) of airborne exposures to beryllium for operations identified. Table 4 represents a breakdown of personal air samples represented as an 8-hr Time Weighted Average from FY2007-FY2010.

Table 4. 8-hr Time Weighted Average of Personal Air Samples FY2007-FY2010

Level	FY2010	FY2009	FY2008	FY2007
No Measurable Level	1696	755	489	597
Measurable but < Action Level	54	9	17	26
> Action Level	6	0	3	2
> PEL	0	0	0	0
Total	1756	764	509	625

[3] Includes blanks.
[4] Analytical reporting limit is 0.02 microgram per sample.

5.0 Discussion

LLNL provides semiannual submissions to the DOE Beryllium Registry, which was initiated in 2002. The Registry provides DOE site specific sensitization and CBD rates for those workers enrolled in beryllium medical surveillance and who participate in BeLPT testing. LLNL's Be registry rates differ from the data analyzed in this report due a number of factors. The DOE registry data does not include individuals who:

- 'Opted' out due to an LLNL Institution Review Board requirement (discontinued in 2007).
- Were provided with a one-time BeLPT but were not identified for Be medical surveillance.
- Were in Be medical surveillance and terminated from LLNL between 1998 and 2002 (beginning of BeLPT testing in 1998 and the implementation of the Be registry).

Data analyzed in this report includes all individuals ever provided a BeLPT by LLNL HSD.

The LLNL sensitization rate of 2.72% continues to be similar to the overall DOE sensitization rate of 2.0%[C]. The LLNL CBD rate of 0.29%, however, is less than half the overall DOE CBD rate of 0.8% (Table 5). The DOE registry data does not include LLNL "concern cases" since a comparable descriptor from other DOE sites is not available.

Table 5. Comparison of DOE Sites

Site	Employees Tested	Beryllium-Affected Workers (Rates)		
		Concern	BeS	CBD
Hanford*	5,441	NI	76 (1.4%)	32 (0.6%)
Y-12*	2,405	NI	92 (3.8%)	55 (2.3%)
LANL*	2,171	NI	18 (0.8%)	3 (0.1%)
LLNL – 2010**	1,359	33	37 (2.72%)	4 (0.29%)
DOE Overall*	17,716	NI	355 (2.0%)	134 (0.8%)

*Source: 2010 DOE Be Registry[C] information is based on information ending in February 18, 2011.
**Source: LLNL Health Services Department
NI: Not Identified. The Beryllium Registry does not collect "Concern" data.

Though personal air monitoring data for Be-affected workers remains limited, workplace area and personal air monitoring that was conducted indicates that exposures were typically below the workplace action level and always below the Permissible Exposure Level (PEL). The majority of such measurements (96.2% of personal air measurements reported in FY2010) were below the analytical reporting limit of the Be-affected cases involving workers or workgroups with no known history of work or exposure to measurable airborne beryllium. Of the 2 Be-affected workers identified since April 2009 that had sampling data, no detectable levels of airborne beryllium was noted for operations which included handling of IH swipe samples, D&D of contaminated equipment, and disassembly of test assemblies.

In this report, 69% (n= 51) Figure 2 of Be-affected workers reported no direct work with beryllium. Such workers however did report work in facilities with historical beryllium activities or with equipment/materials released from facilities with current or historical beryllium work. This analysis suggests that Be sensitization or "concern," may not only occur among those who have a presumed higher risk for airborne exposure to beryllium, such as machinists, or waste handlers but also among presumed lower risk workgroups who may have been exposed through incidental activities.

Research conducted by the Department of Medicine at the University of California San Francisco (UCSF) in collaboration with LLNL health and safety professional staff (Arjomandi, et al [D]) suggest that because of lower average levels of beryllium exposure, a smaller proportion of sensitized workers, at LLNL, may go on to develop CBD when compared to workers with higher exposures. They describe the results of 50 LLNL Be-affected workers' pulmonary evaluations and found that LLNL workers were exposed to generally low levels of beryllium and had a low prevalence of CBD when compared to other high-risk production operations such as beryllium ceramics manufacturing. Because of the low prevalence of CBD among LLNL workers with beryllium sensitization as well as the lack of progression to clinically sever disease among those workers diagnosed with CBD, UCSF has become more comfortable with annual medical follow-up of asymptomatic beryllium-sensitized workers with normal baseline pulmonary function tests and chest imaging instead of early bronchoscopy.

Analysis of these data is difficult and fraught with a number of inherent constraints. These include genetic variability in the development of beryllium sensitivity, limitations of the BeLPT test itself, and the LLNL work environment. For example, there is not a definitive temporal relationship between when an abnormal/borderline BeLPT is identified and when the beryllium exposure may have occurred. Additionally, LLNL's research and development workforce is heavily matrixed. This may result in any one worker having a variety of work assignments and work locations during their employment at the Laboratory. These factors, together with inherent limitations in the BeLPT test and the intrinsic limitations associated with the sampling and analysis of workplace monitoring data, continue to complicate the analysis of Be-affected workers at LLNL.

We are also not able to develop true rates because of the lack of denominators for the numbers of workers from different job classes and activities. These factors result in weak associations rather than clear patterns of cause and effect with respect to Be exposure and subsequent development of sensitization.

6.0 Conclusions

From April 1, 2009 through December 31, 2010, LLNL continued to identify Be-affected workers among its population of current workers. The LLNL rate of sensitized workers is similar to that of the overall DOE Complex as reported in the DOE Beryllium Registry, and the LLNL rate of CBD continues to be lower than the overall CBD rate throughout the DOE Complex. This analysis suggests that Be sensitization or "concern" may not only occur among workgroups who have a presumed higher risk for airborne exposure to beryllium, such as machinists, or waste handlers but also among presumed lower risk workgroups who may have been exposed through incidental activities. Such activities include crafts (electricians, carpenters), and facility support (inspectors, computer technicians, security, and Health & Safety support personnel). The pattern of low exposure levels and sensitization prompts the hypothesis that very little exposure may be required to cause beryllium sensitization in some individuals. If the conclusions of the Arjomandi paper hold true over time, these individuals may be a relatively low risk of CBD.

7.0 Recommendations

Based on the present data, we recommend that communication of potential risks, work controls, and benefits of participating in medical surveillance be made to workers in functional job titles or job activities presented in this report. Additional analysis of Be-affected workers, with work histories less than 10 years, is required.

8.0 Acknowledgments

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9.0 References

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10.0 Definitions

Beryllium-Affected Worker: A worker who has had BeLPT results of 1 abnormal/1borderline, 2 – abnormal, 3 borderline, or who has been diagnosed as having CBD.

Chronic Beryllium Disease (CBD): A lung condition that can develop after an individual breathes beryllium dust or fumes. The disease results from an immune response to beryllium that causes scarring (called granulomas) in the lungs.

“Concern” Beryllium-Affected Worker: Be LPT results of 1 abnormal/1borderline or 3 borderline (adopted in 2006 by LLNL HSD to increase the safety of workers). This change is consistent with the approach used by the DOE National Supplemental Screening Program and the recommendations of the National Academy of Science. It is important to recognize that the “concern” classification is an important diagnostic tool, and through March 2007 1 of the 4 diagnosed CBD cases occurred in an individual identified as “beryllium.”

Sensitized Beryllium-Affected Worker: BeLPT results of 2 abnormals.

BeLPT: Beryllium Lymphocyte Proliferation Test.